Florentin Smarandache

Introduction to Neutrosophic Sociology (Neutrosociology)

(70% democratic, 10% indeterminate-democracy, 40% nondemocratic)

a + bI

refined $(T_1, T_2, \ldots; I_1, I_2, \ldots; F_1, F_2, \ldots)$-concept

(T, I, F)-concept

(<A>, <neutA>, <antiA>)

pons

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Foreword

0.1. Definition of Neutrosophic Sociology (Neutrosociology)

Neutrosophic Sociology (or **Neutrosociology**) is the study of sociology using neutrosophic scientific methods.

The huge social data that we face in sociology is full of *indeterminacy*: it is vague, incomplete, contradictory, hybrid, biased, ignorant, redundant, superfluous, meaningless, ambiguous, unclear, etc.

That's why the *neutrosophic sciences* (which deal with indeterminacy) should be involved, such as: neutrosophy (a new branch of philosophy), neutrosophic set, neutrosophic logic, neutrosophic probability and neutrosophic statistics, neutrosophic analysis, neutrosophic measure, and so on.

A *Neutrosophic Appurtenance* of an element x with respect to a given neutrosophic set has the form $x(T, I, F)$, where T is the degree of truth (or membership, or chance of occurring) of the element x, I is the degree of indeterminate-truth (or indeterminate-membership, or indeterminate-chance) of x, and F the degree of falsehood (or nonmembership, or chance of nonoccurrence) of x, where T, I, F are independent neutrosophic components, and T, I, F are subsets of the interval $[0, 1]$.

{For simplicity, we take T, I, F as single-valued numbers from the interval *[0, 1],* with $0 \leq T + I + F \leq 3$}.

The process of converting a crisp concept {i.e. *(1, 0, 0)-concept*, which means concept that is *100%* true, *0%* indeterminate, and *0%* false} into a neutrosophic concept {i.e. *(T, I, F)-concept*, which is T% true, I% indeterminate, and F% false – which more accurately reflects our imperfect, non-idealistic reality} is called *neutrosophication*.

Similarly, the converting of a crisp *(1* or *0),* fuzzy *(T),* or intuitionistic fuzzy *(T, F)* appurtenance of an element x to a neutrosophic *(T, I, F)* appurtenance;

or converting a crisp (exact) number N into a neutrosophic number $N = a + bI$, where a is the determinate part of number N and bI the indeterminate part of number N;

are parts of the neutrosophication.

For example, let's consider the (classical) crisp concept "democracy". In classical sociology, saying that a country C is democratic, one mutually understand that C is *100%* democratic. Using the neutrosophic number notation, we write C is *(1, 0, 0)-democratic*, meaning that country C is *100%* democratic, *0%* indeterminate-democratic, and *0%* nondemocratic.

But, making a deeper investigation about the democracy of country C, we find out that there are several laws in country C that are nondemocratic, in proportion of let's say *20%*. In this case, we write *(0.8, 0, 0.2)-democracy*.

Digging further into the country *C*'s democracy, we discover that there is some governmental regulation in percentage of *10%* that several political analysts classify as democratic but human-right activists as nondemocratic… So, this is the indeterminate / contradictory information about *C*'s democracy. We end up re-writing: *(0.7, 0.1, 0.2)-democracy*.

Therefore, the *(T, I, F)-democracy* more accurately describes country *C*'s democracy than the classical *(1, 0, 0)-democracy*.

A *refined (T, I, F)-concept* has the shape: *(T1, T2, …; I1, I2, …; F1, F2,…)-concept*, where the neutrosophic components *T, I, F* are split / refined into subcomponents respectively, according to the neutrosophic expert and to the application or problem to solve.

As an example, in neutrosophic microsociology, using refined neutrosophic probability, let's check the power of a soccer team S_1 with respect to another soccer team S_2. We may to refine the possible output as follows:

T_1 = the chance that S_1 wins against S_2 with one more goal difference (i.e. *1-0, 2-1, 3-2,* etc.);

T_2 = the chance that S_1 wins against S_2 with two or more goals difference (i.e. *2-0, 3-0, 4-1, 6-2,* etc.);

I_1 = the chance that S_1 and S_2 have an equal game with no goal marked (i.e. 0-0);

I_2 = the chance that S_1 and S_2 have an equal game but with marked goals (i.e. 1-1, 2-2, 3-3, etc.);

$\mathbb{F}_1$ = the chance that S_1 is defeated by S_2 with one more goal difference (i.e. *0-1, 1-2, 2-3,* etc.);

$\mathbb{F}_2$ = the chance that S_1 is defeated by S_2 with two or more goals difference (i.e. *0-2, 0-3, 2-5, 1-6,* etc.).

According to the sport experts, one has let's say:

$\mathbb{T}_1 = 0.5$, $\mathbb{T}_2 = 0.3$, $\mathbb{I}_1 = 0.0$, $\mathbb{I}_2 = 0.2$, $\mathbb{F}_1 = 0.4$, and $\mathbb{F}_2 = 0.1$.

Therefore the *refined* S_1 *vs.* S_2 *victory* concept is:

(0.5, 0.3; 0.0, 0.2; 0.4, 0.1)-victory.

Neutrosophy studies only the triads *(<A>, <neutA>, <antiA>),* where *<A>* is an item or a concept, that make sense in the real world.

Similarly is for Dialectic that studies the dynamic of opposites *<A>* and *<antiA>,*

it is referred to the dyad *(<A>, <antiA>)* that makes sense in the real world.

Consequently, the neutrosophication of a *concept* into a *($\mathbb{T}$, $\mathbb{I}$, $\mathbb{F}$)-concept,* or more general into a *refined ($\mathbb{T}_1$, $\mathbb{T}_2$, …; $\mathbb{I}_1$, $\mathbb{I}_2$, …; $\mathbb{F}_1$, $\mathbb{F}_2$,…)-concept*, is possible if the triad *(<Concept>, <neutConcept>, <antiConcept>),* or more general its corresponding refined concept triad, makes sense in the real world.

0.2. Examples of Triads and Refined Triads

1. If *<A>* = *Table*, then *<antiTable>* and *<neutTable>* do not make sense in the real world, so we do not have a neutrosophic triad, nor a dyad.

2. If <*A*> = *Man,* then <*antiMan*> = *Woman,* and <*neutMan*> = *Transgender,* whence the triad <*Man, Transgender, Woman*> makes sense in the real world, therefore it is a neutrosophic triad.

In general, for <*A*> as a material thing, there is a less number of corresponding neutrosophic triads.

But for <*A*> as spiritual thing (idea, theory, attribute, sentiment, etc.), there are many corresponding neutrosophic triads.

A classical sociological *Concept*, such as: society, social class, social group, religious community, minority community, social network, social media friends, cyber-space interaction, Internet relationship, social stratification, social relationship, principle, law, welfare, government regulation, political party, sexuality, deviance, social disorder, family, culture, etc. that may be represented as a real world neutrosophic triad

(<Concept>, <neutConcept>, <antiConcept>)

or as a real world refined neutrosophic triad

(<Concept$_1$>, <Concept$_2$>, …; <neutConcept$_1$>, <neutConcept$_2$>, …; <antiConcept$_1$>, <antiConcept$_2$>,…)

may be neutrosophicated into a

(T, I, F)-concept, or respectively into a

refined (T_1, T_2, …; I_1, I_2, …; F_1, F_2,…)-concept,

and they better model the social reality than the classical sociological analyses.

0.3. Neutrosophic Degrees

In all societies we find neutrosophic degrees of positive (*T*), indeterminate or neutral (*I*), and negative (*F*) attributes, therefore we could say that in any society we have the following neutrosophic degrees:

(T_i, I_i, F_i)-inequality, (T_u I_u, F_u)-unhappiness, (T_c, I_c, F_c)-contradiction, (T_w, I_w, F_w)-wrongdoing, and so on,

unlike Auguste Compte's (who coined the 'sociology' term) "perfect society" – because we people are imperfect and commit mistakes.

The neutrosophic degrees are dynamic, they continuously change in time upon various hidden or unhidden parameters that influence them.

First Chapter

Neutrosophication and Deneutrosophication

1.1. Definition of Neutrosophication

Neutrosophication means either to transform a crisp value into a neutrosophic component triplet $(\mathcal{T}, \mathcal{I}, \mathcal{F})$, with $\mathcal{T}, \mathcal{I}, \mathcal{F} \subseteq [0,1]$; or a classical set item x belonging 100% to a classical set $\mathcal{M}_C, x(1,0,0) \in \mathcal{M}_C$, as a neutrosophic item x that only partially belong to a neutrosophic set $\mathcal{M}_N$: $x(\mathcal{T}, \mathcal{I}, \mathcal{F}) \in \mathcal{M}_N$, with $\mathcal{T}, \mathcal{I}, \mathcal{F} \subseteq [0,1]$; or for an item x, belonging to a set $\mathcal{S}$, to find with respect to some attribute the neut$(x) \in \mathcal{S}$ and anti$(x) \in \mathcal{S}$ if any.

Neutrosophication also means: the process of transposing a proposition $\mathcal{P}$ from a space $\mathcal{S}_1$ to another space $\mathcal{S}_2$, and in the same time adjusting its neutrosophic truth-value: $\mathcal{P}(\mathcal{T}_{\mathcal{S}_1}, \mathcal{I}_{\mathcal{S}_1}, \mathcal{F}_{\mathcal{S}_1}) \rightarrow \mathcal{P}(\mathcal{T}_{\mathcal{S}_2}, \mathcal{I}_{\mathcal{S}_2}, \mathcal{F}_{\mathcal{S}_2})$, where $\mathcal{T}_{\mathcal{S}_1}, \mathcal{I}_{\mathcal{S}_1}, \mathcal{F}_{\mathcal{S}_1}$ are the neutrosophic degrees of truth (membership), indeterminacy, falsehood respectively of the proposition $\mathcal{P}$ with respect to space $\mathcal{S}_1$, while $\mathcal{T}_{\mathcal{S}_2}, \mathcal{I}_{\mathcal{S}_2}, \mathcal{F}_{\mathcal{S}_2}$ similarly, but with respect to space $\mathcal{S}_2$.

In this book, we do a neutrosophication from the classical to the neutrosophic environment.

1.2. Applications of Neutrosophication

Three most known applications are:

— from classical to neutrosophic: $\mathcal{P}(1,0,0) \rightarrow \mathcal{P}(\mathcal{T}_{\mathcal{S}_2}, \mathcal{I}_{\mathcal{S}_2}, \mathcal{F}_{\mathcal{S}_2})$;

— from fuzzy to neutrosophic: $\mathcal{P}(\mathcal{T}_{\mathcal{S}}, 0, 0) \rightarrow \mathcal{P}(\mathcal{T}_{\mathcal{S}_2}, \mathcal{I}_{\mathcal{S}_2}, \mathcal{F}_{\mathcal{S}_2})$;

— from intuitionistic fuzzy to neutrosophic: $\mathcal{P}(\mathcal{T}_{\mathcal{S}_1}, H_{\mathcal{S}_1}, \mathcal{F}_{\mathcal{S}_1}) \to \mathcal{P}(\mathcal{T}_{\mathcal{S}_2}, \mathcal{I}_{\mathcal{S}_2}, \mathcal{F}_{\mathcal{S}_2})$, where $H_{\mathcal{S}_1}$ is the hesitant degree in intuitionistic fuzzy environment;

— in general, from a neutrosophic space to another neutrosophic space: $\mathcal{P}(\mathcal{T}_{\mathcal{S}_1}, \mathcal{I}_{\mathcal{S}_1}, \mathcal{F}_{\mathcal{S}_1}) \to \mathcal{P}(\mathcal{T}_{\mathcal{S}_2}, \mathcal{I}_{\mathcal{S}_2}, \mathcal{F}_{\mathcal{S}_2})$.

Many classical results may be extended from an exact space (space with no indeterminacy) to a space with indeterminacy – as all our reality spaces are. Rarely there are perfect, absolute, theoretical, idealistic spaces – mostly in pure sciences.

A classical item (or entity) $\mathcal{P}$, that may be: a term, concept, notion, proposition, theorem, lemma, axiom, property, rule, algorithm, idea, thesis, hypothesis, consequence, theory, etc., that is 100% true in a classical, perfect, abstract, or theoretical, absolute space, in another space the same item $\mathcal{P}$ may be only partially true (and partially indeterminate, and partially false).

In each space $\mathcal{S}$, $\mathcal{P}$ has a specific neutrosophic truth-value as follows: a degree of truth-membership ($\mathcal{T}_{\mathcal{S}}$), a degree of indeterminacy-membership ($\mathcal{I}_{\mathcal{S}}$), and a degree of falsehood-membership ($\mathcal{F}_{\mathcal{S}}$), where:

$\mathcal{T}_{\mathcal{S}}, \mathcal{I}_{\mathcal{S}}, \mathcal{F}_{\mathcal{S}} \subseteq [0, 1]$.

1.3. Neutrosophication Notations

That's why we use the notation: $(\mathcal{T}_{\mathcal{S}}, \mathcal{I}_{\mathcal{S}}, \mathcal{F}_{\mathcal{S}})$ - proposition $\mathcal{P}$, or $\mathcal{P}(\mathcal{T}_{\mathcal{S}}, \mathcal{I}_{\mathcal{S}}, \mathcal{F}_{\mathcal{S}})$.

1.4. Deneutrosophication

Deneutrosophication is the operation opposite to neutrosophication, meaning moving back if possible:

— from partial truth-values to classical (0 or 1 only) truth-values;

— from imperfect (with indeterminacy) spaces to perfect (no indeterminacy) spaces;

— from spaces where the elements only partially belong, to the spaces where the elements totally belong;

— from triplets ($\langle A\rangle$, $neut\langle A\rangle$, $anti\langle A\rangle$) to unary ($\langle A\rangle$) items or entities.

1.5. Classical (Crisp) Universe of Discourse (CU)

Let x be a generic **item** (or entity), such as: element, concept, object, notion, attribute, idea, logical or scientific proposition, theorem, lemma, axiom, algorithm, principle, procedure field of knowledge, scientific or literary or artistic movement, theory, etc.

CU is a set of all possible elements used in a given theory.

Let x be a classical element.

By $x \in CU$, we mutually understand that x belongs 100% (entirely) to the set CU and, using a neutrosophic notation, we write: $x(1,0,0) \in CU$.

But in our everyday life, and in practical applications, and in many theories, there exist

elements that only partially belong to a given set (set such as: society, association, organization, etc.).

*

Now we introduce for the first time the Fuzzy Universe of Discourse, and Intuitionistic Fuzzy Universe of Discourse.

1.6. Fuzzy Universe of Discourse (*FU*)

FU is a set of elements x, such that: $\forall\ \mathcal{T} \subseteq [0,1]$, $x(\mathcal{T}) \in FU$, where $\mathcal{T}$ is a subunitary set, and it represents the degree of truth (membership) of the element x with respect to the set *FU*.

Therefore, each element x of *FU* belongs with all possible truth (membership) degrees to the set *FU*.

1.7. Intuitionistic Fuzzy Universe of Discourse (*IFU*)

IFU is a set of elements x, such that: $\forall\ \mathcal{T}, \mathcal{F} \subseteq [0,1]$, $x(\mathcal{T}, \mathcal{F}) \in IFU$, where $\mathcal{T}$ and $\mathcal{F}$ are subunitary sets that represent the degrees of truth (membership) and falsehood (nonmembership) respectively of the element x with respect to the set *IFU*.

Therefore, each element x of *IFU* belongs with all possible truth (membership) and falsehood (nonmembership) degrees to the set *IFU*.

1.8. Neutrosophic Universe of Discourse of Type-1 (*NU1*), also sometimes called Neutrosophic Fuzzy Universe of Discourse (NFU)

NU1 is a set of elements x, such that: $\forall\ \mathcal{T},\mathcal{I},\mathcal{F} \subseteq [0,1]$, $x(\mathcal{T},\mathcal{I},\mathcal{F}) \in NU1$, where $\mathcal{T}$, $\mathcal{I}$ and $\mathcal{F}$ are subunitary sets that represent the degrees of truth (membership), indeterminacy (or neutrality), and respectively falsehood (nonmembership) of the element x with respect to the neutrosophic universal set *NU1*.

Therefore, if an element $x \in NU1$, then x belongs to *NU1* with all possible neutrosophic degrees of truth (membership), indeterminacy, and falsehood (nonmembership). In other words:

$x(\mathcal{T},\mathcal{I},\mathcal{F}) \in NU1$ for any $\mathcal{T},\mathcal{I},\mathcal{F} \subseteq [0,1]$.

1.9. Neutrosophic Intuitionistic Fuzzy Universe of Discourse (*NIFU*)

It is a set *NIFU*, of elements x , such that: $\forall\ \mathcal{T}_{\mathcal{T}},\mathcal{T}_{\mathcal{F}},\mathcal{I}_{\mathcal{T}},\mathcal{I}_{\mathcal{F}},\mathcal{F}_{\mathcal{T}},\mathcal{F}_{\mathcal{F}} \subseteq [0,1]$, $x \in \big((\mathcal{T}_{\mathcal{T}},\mathcal{T}_{\mathcal{F}}),(\mathcal{I}_{\mathcal{T}},\mathcal{I}_{\mathcal{F}}),(\mathcal{F}_{\mathcal{T}},\mathcal{F}_{\mathcal{F}})\big) \in NIFU$, where:

— $\mathcal{T}_{\mathcal{T}},\mathcal{T}_{\mathcal{F}}$ represent the intuitionistic degrees of truth (membership) and falsehood (nonmembership), respectively of $\mathcal{T}$ (the neutrosophic truth), of the element x, with respect to *NIFU*;

— $\mathcal{I}_{\mathcal{T}},\mathcal{I}_{\mathcal{F}}$ represent the intuitionistic degrees of truth (membership) and falsehood (nonmembership),

respectively of $\mathcal{I}$ (the neutrosophic indeterminacy), of the element x, with respect to *NIFU*;

— and $\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{F}}$ represent the intuitionistic degrees of truth (membership) and falsehood (nonmembership), respectively of $\mathcal{F}$ (the neutrosophic falsehood), of the element x, with respect to *NIFU*.

This is a hybrid universe of discourse.

1.10. Neutrosophic Universe of Discourse of Type-2 (*NU2*)

NU2 is a set of elements x, such that: $\forall \mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{I}}, \mathcal{T}_{\mathcal{F}}, \mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{I}}, \mathcal{I}_{\mathcal{F}}, \mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{I}}, \mathcal{F}_{\mathcal{F}} \subseteq [0,1]$, $x \in \big((\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{I}}, \mathcal{T}_{\mathcal{F}}), (\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{I}}, \mathcal{I}_{\mathcal{F}}), (\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{I}}, \mathcal{F}_{\mathcal{F}})\big) \in NU2$, where:

— $\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{I}}, \mathcal{T}_{\mathcal{F}}$ represent the second neutrosophic degrees of truth (membership), indeterminacy, and falsehood (nonmembership), respectively of $\mathcal{T}$ [the first neutrosophic degree of truth (membership)];

— $\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{I}}, \mathcal{I}_{\mathcal{F}}$ represent the second neutrosophic degrees of truth (membership), indeterminacy, and falsehood (nonmembership), respectively of $\mathcal{I}$ [the first neutrosophic degree of indeterminacy];

— and $\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{I}}, \mathcal{F}_{\mathcal{F}}$ represent the second neutrosophic degrees of truth (membership), indeterminacy, and falsehood (nonmembership), respectively of $\mathcal{F}$ [the first neutrosophic degree of falsehood (nonmembership)].

1.11. Neutrosophic Triplet Crisp Universe of Discourse

Let α be an attribute value. Let *NTCU* denote a **Neutrosophic Triplet Universe of Discourse**, which is defined as follows: for any $x \in NTCU$, there exist an opposite of x, denoted by $anti(x) \in NTCU$, and a neutral (or indeterminate) of x that is neither x nor anti(x), denoted by $neut(x) \in NTCU$.

The Neutrosophic Triplet Universe of Discourse is roughly similar to the *Neutrosophic Triplet Set*, but occurs at the universal (most general) level.

The opposite of item x means that item whose characteristics with respect to attribute value α are opposed to those of x.

Therefore, the triad forms a neutrosophic triplet $\langle x, neut(x), anti(x)\rangle$ that belongs to *NTCU*.

And the neutral item of x means that item whose characteristics with respect to attribute value α are different from those of x and of anti(x).

For an item x with respect to attribute value α, there may exist more anti(x)'s and more neut(x)'s, depending on the neutrosophic field of knowledge and on the application / problem to solve.

1.12. Remark

This definition can be similarly extended for multi-attribute values.

*

A neutrosophic triplet crisp universe of discourse may have all its elements $<x, neut(x), anti(x)>$ endowed with either fuzzy, intuitionistic fuzzy, or neutrosophic degrees of truth-(appurtenance)-values with respect to the *NTCU*.

Thus, we have the following definitions, combining the previous ones.

1.13. Neutrosophic Triplet Fuzzy Universe (*NTFU*) of Discourse

NTFU is a neutrosophic triplet universe of discourse, if each of its triplets' elements $<x, neut(x), anti(x)>$ are endowed with fuzzy degrees ($\mathcal{T}$) of truth (membership) with respect to the set *NTFU*, where $\mathcal{T} \subseteq [0,1]$.

They are denoted as follows:

$<x(\mathcal{T}_x), neut(x)(\mathcal{T}_{neut(x)}), anti(x)(\mathcal{T}_{anti(x)})>$, $\forall\ x \in$ *NTFU*.

It is a combination of *NTCU* and *FU*.

1.14. Neutrosophic Triplet Intuitionistic Fuzzy Universe (*NTIFU*) of Discourse

NTIFU is a neutrosophic triplet universe of discourse, if each of its triplets' elements $<x, neut(x), anti(x)>$ are endowed with intuitionistic fuzzy degrees ($\mathcal{T}$, $\mathcal{F}$) of truth (membership) and respectively false (nonmembership) with respect to the set *NTIFU*, where $\mathcal{T}, \mathcal{F} \subseteq [0,1]$.

They are denoted as follows:

$< x\,(\mathcal{T}_x,\ \mathcal{F}_x),\ neut(x)(\ \mathcal{T}_{neut(x)},\ \mathcal{F}_{neut(x)}),\ anti(x)\ (\mathcal{T}_{anti(x)}, \mathcal{F}_{anti(x)})>,\ \forall\ x \in NTIFU.$

It is a combination of *NTCU* and *IFU*.

1.15. Neutrosophic Triplet Neutrosophic Universe (*NTNU*) of Discourse

NTIFU is a neutrosophic triplet universe of discourse, if each of its triplets' elements $<x, neut(x), anti(x)>$ are endowed with neutrosophic degrees ($\mathcal{T}$, $\mathcal{I}$, $\mathcal{F}$) of truth (membership), indeterminacy and respectively falsehood (nonmembership) with respect to the set *NTNU*, where $\mathcal{T}, \mathcal{I}, \mathcal{F} \subseteq [0,1]$.

They are denoted as follows:

$< x\,(\mathcal{T}_x,\ \mathcal{I}_x\ \ \mathcal{F}_x),\ neut(x)(\ \mathcal{T}_{neut(x)},\ \mathcal{I}_{neut(x)},\ \mathcal{F}_{neut(x)}),\ anti(x)\ (\mathcal{T}_{anti(x)}, \mathcal{J}_{anti(x)}, \mathcal{F}_{anti(x)})>,\ \forall\ x \in NTNU.$

It is a combination of *NTCU* and *NU1*.

1.16. Theorem 1: Connectivity between *NU*1, *NTCU*, and *NTFU*

The neutrosophic appurtenance of first (fuzzy) type $x(\mathcal{T}, \mathcal{I}, \mathcal{F}) \in NU1$, for all $\mathcal{T}, \mathcal{I}, \mathcal{F} \subseteq [0,1]$, is equivalent to:

There exist a neutrosophic triplet $< x,\ neut(x),\ anti(x)>$ in *NTCU* that may be represented in *NTFU* as $<x(\mathcal{T}),\ neut(x)(\mathcal{I}),\ anti(x)(\mathcal{F})>$, which means:

— the fuzzy degree of truth (membership) of x with respect to *NTFU* is $\mathcal{T}$;

— the fuzzy degree of truth (membership) of neut(x) with respect to *NTFU* is $\mathcal{I}$;

— and the fuzzy degree of truth (membership) on anti(x) with respect to NTFU is $\mathcal{F}$.

Proof is abvious.

1.17. Theorem 2: Connectivity between *NIFU*, *NTCU*, and *NTIFU*

The neutrosophic appurtenance of second (intuitionistic fuzzy) type
$x((\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{F}}), (\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{F}}), (\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{F}})) \in NIFU$, for any $\mathcal{T}_{\mathcal{T}}$, $\mathcal{T}_{\mathcal{F}}$, $\mathcal{I}_{\mathcal{T}}$, $\mathcal{I}_{\mathcal{F}}, \mathcal{F}_{\mathcal{T}}$, $\mathcal{F}_{\mathcal{F}} \subseteq [0,1]$, where

— $\mathcal{T}_{\mathcal{T}}$, $\mathcal{T}_{\mathcal{F}}$ represent the intuitionistic truth (membership) and falsehood (nonmembership) degrees respectively of $\mathcal{T}$ [which is the neutrosophic truth (membership) degree] of element x, with respect to *NTIFU*;

— $\mathcal{I}_{\mathcal{T}}$, $\mathcal{I}_{\mathcal{F}}$ represent the intuitionistic truth (membership) and falsehood (nonmembership) degrees respectively of $\mathcal{I}$ [which is the neutrosophic indeterminacy degree] of element x, with respect to *NTIFU*;

— and $\mathcal{F}_{\mathcal{T}}$, $\mathcal{F}_{\mathcal{F}}$ represent the intuitionistic truth (membership) and falsehood (nonmembership) degrees respectively of $\mathcal{F}$ [which is the neutrosophic falsehood (nonmembership) degree] of element x, with respect to *NTIFU*;

is equivalent to:

There exist a neutrosophic triplet $< x, neut(x), anti(x) >$ in *NTCU* that may be represented in *NTIFU* as $< x(\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{F}}), neut(x)(\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{F}}), anti(x)(\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{F}}) >$, which mean:

— the intuitionistic fuzzy degrees of truth (membership) and falsehood (nonmembership) of x, with respect to *NTIFU*, are $\mathcal{T}_{\mathcal{T}}$, $\mathcal{T}_{\mathcal{F}}$ respectively;

— the intuitionistic fuzzy degrees of truth (membership) and falsehood (nonmembership) of neut$x$, with respect to *NTIFU*, are $\mathcal{I}_{\mathcal{T}}$, $\mathcal{I}_{\mathcal{F}}$ respectively;

— the intuitionistic fuzzy degrees of truth (membership) and falsehood (nonmembership) of anti$x$, with respect to *NTIFU*, are $\mathcal{F}_{\mathcal{T}}$, $\mathcal{F}_{\mathcal{F}}$ respectively.

Proof is obvious.

1.18. Theorem 3: Connectivity between *NU2*, *NTU*, and *NTNU*

The neutrosophic appurtenance of third (neutrosophic) type:

$x\big((\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{J}}, \mathcal{T}_{\mathcal{F}}), (\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{J}}, \mathcal{I}_{\mathcal{F}}), (\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{J}}, \mathcal{F}_{\mathcal{F}})\big) \in NUNU$, for any $\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{J}}, \mathcal{T}_{\mathcal{F}}, \mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{J}}, \mathcal{I}_{\mathcal{F}}, \mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{J}}, \mathcal{F}_{\mathcal{F}} \subseteq [0,1]$, $x \in NU2$, where:

— $\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{J}}, \mathcal{T}_{\mathcal{F}}$ represent the second neutrosophic truth (membership), indeterminacy, falsehood (nonmembership) degrees respectively of $\mathcal{T}$ [which is the first neutrosophic truth (membership) degree] of the element x, with respect to *NTNU*;

— similarly, $\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{J}}, \mathcal{I}_{\mathcal{F}}$ represent the second neutrosophic truth (membership), indeterminacy, falsehood (nonmembership) degrees respectively of $\mathcal{I}$

[which is the first neutrosophic indeterminacy degree] of the element x, with respect to *NTNU*;

— and $\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{I}}, \mathcal{F}_{\mathcal{F}}$ represent the second neutrosophic truth (membership), indeterminacy, falsehood (nonmembership) degrees respectively of $\mathcal{F}$ [which is the first neutrosophic falsehood (nonmembership) degree] of the element x, with respect to *NTNU*.

The element x is called **neutrosophic element of type 2**, and the whole set NTNU is called **neutrosophic set** (**universe** in this case) **of type 2**.

Which is equivalent to:

There exist a neutrosophic triplet $< x, neut(x), anti(x) >$ in *NTCU* that may be represented in *NTNU* as $< x(\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{I}}, \mathcal{T}_{\mathcal{F}}), neut(x)(\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{I}}, \mathcal{I}_{\mathcal{F}}), anti(x)(\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{I}}, \mathcal{F}_{\mathcal{F}}) >$, which mean:

— the neutrosophic degrees of truth (membership), indeterminacy and falsehood (nonmembership) of x, with respect to *NTNU*, are $\mathcal{T}_{\mathcal{T}}, \mathcal{T}_{\mathcal{I}}, \mathcal{T}_{\mathcal{F}}$ respectively;

— the neutrosophic degrees of truth (membership), indeterminacy and falsehood (nonmembership) of neut$x$, with respect to *NTNU*, are $\mathcal{I}_{\mathcal{T}}, \mathcal{I}_{\mathcal{I}}, \mathcal{I}_{\mathcal{F}}$ respectively;

— and the neutrosophic degrees of truth (membership), indeterminacy and falsehood (nonmembership) of anti$x$, with respect to *NTNU*, are $\mathcal{F}_{\mathcal{T}}, \mathcal{F}_{\mathcal{I}}, \mathcal{F}_{\mathcal{F}}$ respectively.

Proof is obvious.

1.19. Particular cases of the Components of Fuzzy ($\mathcal{T}$), Intuitionistic Fuzzy ($\mathcal{T}$, $\mathcal{F}$), and Neutrosophic ($\mathcal{T}$, $\mathcal{I}$, $\mathcal{F}$) Sets and Logics and their Applications

a) If $\mathcal{T}$, $\mathcal{I}$, $\mathcal{F}$ are single-valued numbers from the unit interval $[0,1]$, then we have: **Single-Valued Fuzzy Set and Logic** ($\mathcal{T} \in [0,1]$), **Single-Valued Intuitionistic Fuzzy Set and Logic** ($\mathcal{T}, \mathcal{F} \in [0,1]$), and **Single-Valued Neutrosophic Set and Logic** ($\mathcal{T}, \mathcal{I}, \mathcal{F} \in [0,1]$).

b) If $\mathcal{T}$, $\mathcal{I}$, $\mathcal{F}$ are interval-values included in $[0,1]$, then we have **Interval-Valued Fuzzy Set and Logic** ($\mathcal{T} = [a,b] \subseteq [0,1]$), **Interval-Valued Intuitionistic Fuzzy Set and Logic** ($\mathcal{T} = [a,b], \mathcal{F} = [c,d], \mathcal{T}, \mathcal{F} \subseteq [0,1]$), and **Interval-Valued Neutrosophic Set and Logic** ($\mathcal{T} = [a,b], \mathcal{F} = [c,d], \mathcal{I} = [e,f], \mathcal{T}, \mathcal{I}, \mathcal{F} \subseteq [0,1]$).

c) If $\mathcal{T}$, $\mathcal{I}$, $\mathcal{F}$ are finite discrete sets of numbers, of the form $\{a_1, a_2, \dots, a_n\} \subset [0,1]$, where n is a finite positive integer, called hesitant sets, then we have: **Hesitant Fuzzy Set and Logic** ($\mathcal{T} \subset [0,1]$ is a hesitant set), **Hesitant Intuitionistic Fuzzy Set and Logic** ($\mathcal{T}, \mathcal{F} \subset [0,1]$ are hesitant sets), and **Hesitant Neutrosophic Set and Logic** ($\mathcal{T}, \mathcal{I}, \mathcal{F} \subset [0,1]$ are hesitant sets).

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For simplicity, in many of the following examples and applications, we use the *single-valued* forms.

Second Chapter

Introduction to Neutrosociology

2.1. Preliminaries to Neutrosophic Sociology (Neutrosociology)

As a scientist, I got interested in investigating socio-political events from a mathematical point of view:

— Is it possible to design an equation, or operator, or mathematical structure or tool that describes social phenomena?

— How to model unmodelling social things?

— Can we scientifically predict and model how our **society** will look like one hundred, one thousand years from now?

— What wars, revolutions, riots, invasions, attacks might happen? Neutrosophic probability of a new World War?

— How the future society will be structured and organized or disorganized in the future?

— Will it still be divided by classes?

— What type of **family** will be the most spread in the future?

— The traditional (man + woman) family, the single parent family (bachelor), the polygamy and polyandry, the group family, the transgender family, or no family at all?

— Each human generation is different from the previous generations… May Markov chain probability method work with good accuracy?

— How to predict the social change?

Studying the past, we may partially have an idea about the future.

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We use **neutrosophic systematic observations** [observations that contain indeterminate data] of past and present societies in order to construct **neutrosophic theories** that may describe with a (t, i, f)-neutrosophic probabilistic approximation the new possible type of social structure.

We call these theories "neutrosophic" because they cannot escape from dealing with "indeterminacy".

The **social world** has a high degree of subjectivity, and of many contradictory trends and opinions. There is hardly a unanimity of social ideas, while a high degree of how-I'd-like-to-be is unfortunately inserted into the researcher's **social model** built.

We, humans, are capable of unconscious and conscious analyses of our world. In a permanently changeable sociological situations and relationships between individuals and social groups, permanently changeable world, we need adaptable, flexible, and permanently changeable accordingly theories and models.

*

Empirical arguments have degrees of indeterminacy in their core. We test these arguments using data, which have also degrees of indeterminacy, randomness, incompleteness.

For sociological ideas, we partially agree, partially disagree, and partially are unsure.

2.2. Definition of Neutrosophic Sociology [Neutrosociology]

Neutrosophic Sociology (or Neutrosociology) is the study of sociology using neutrosophic scientific methods.

The huge social data that we face in sociology is full of *indeterminacy*: it is vague, incomplete, contradictory, hybrid, biased, ignorant, redundant, superfluous, meaningless, ambiguous, unclear, etc.

That's why the *neutrosophic sciences* (which deal with indeterminacy) should be involved, such as: neutrosophy (a new branch of philosophy), neutrosophic set, neutrosophic logic, neutrosophic probability and neutrosophic statistics, neutrosophic analysis, neutrosophic measure, and so on.

A *Neutrosophic Appurtenance* of an element x with respect to a given neutrosophic set has the form: $x(T, I, F)$, where T is the degree of truth (or membership, or chance of occurring) of the element x, I is the degree of indeterminate-truth (or indeterminate-membership, or indeterminate-chance) of x, and F the degree of falsehood (or nonmembership, or chance of nonoccurrence) of x, where T, I, F are independent neutrosophic components, and T, I, F are subsets of the interval $[0, 1]$.

{For simplicity, we take T, I, F as single-valued numbers from the interval $[0, 1]$, with $0 \leq T + I + F \leq 3$}.

The process of converting a crisp concept {i.e. *(1, 0, 0)-concept*, which means concept that is *100%* true, *0%* indeterminate, and *0%* false} into a neutrosophic concept {i.e. *(T, I, F)-concept*, which is *T%* true, *I%* indeterminate, and *F%* false – which more accurately reflects our imperfect, non-idealistic reality} is called *neutrosophication*. Similarly for converting a crisp (exact) number N into a neutrosophic number $N = a + bI$, where a is the determinate part of number N and bI the indeterminate part of number N.

For example, let's consider the (classical) crisp concept "democracy". In classical sociology, saying that a country C is democratic, one mutually understand that C is *100%* democratic. Using the neutrosophic number notation, we write C is *(1, 0, 0)-democratic*, meaning that country C is *100%* democratic, *0%* indeterminate-democratic, and *0%* nondemocratic.

But, making a deeper investigation about the democracy of country C, we find out that there are several laws in country C that are nondemocratic, in proportion of let's say *20%*. In this case, we re-write *(0.8, 0, 0.2)-democracy*.

Digging further into the country C's democracy, we discover that there is some governmental regulation in percentage of *10%* that several political analysts classify as democratic but human-right activists as nondemocratic… So, this is the indeterminate / contradictory information about C's democracy. We end up re-re-writing: *(0.7, 0.1, 0.2)-democracy*.

Therefore, the *(T, I, F)-democracy* more accurately describes country *C*'s degree of democracy than the classical *(1, 0, 0)-democracy*.

A *refined (T, I, F)-concept* has the shape: *(T1, T2, …; I1, I2, …; F1, F2,…)-concept*, where the neutrosophic components *T, I, F* are split / refined into subcomponents respectively, according to the neutrosophic expert and to the application or problem to solve.

As an example, in neutrosophic microsociology, using refined neutrosophic probability, let's check the power of a soccer team S_1 with respect to another soccer team S_2. We may refine the possible output as follows:

T_1 = the chance that S_1 wins against S_2 with one more goal difference (i.e. *1-0, 2-1, 3-2,* etc.);

T_2 = the chance that S_1 wins against S_2 with two or more goals difference (i.e. *2-0, 3-0, 4-1, 6-2,* etc.);

I_1 = the chance that S_1 and S_2 have an equal game with no goal marked (i.e. 0-0);

I_2 = the chance that S_1 and S_2 have an equal game but with marked goals (i.e. 1-1, 2-2, 3-3, etc.);

F_1 = the chance that S_1 is defeated by S_2 with one more goal difference (i.e. *0-1, 1-2, 2-3,* etc.);

F_2 = the chance that S_1 is defeated by S_2 with two or more goals difference (i.e. *0-2, 0-3, 2-5, 1-6,* etc.).

According to the sport experts, one has let's say:

$T_1 = 0.5$, $T_2 = 0.3$, $I_1 = 0.0$, $I_2 = 0.2$, $F_1 = 0.4$, and $F_2 = 0.1$.

Therefore the *refined S_1 vs. S_2 victory* concept is: *(0.5, 0.3; 0.0, 0.2; 0.4, 0.1)-victory.*

2.3. Triads and Neutrosophic Triads

Neutrosophy studies the triads *(<A>, <neutA>, <antiA>),* where *<A>* is an item or a concept, that make sense in the real world.

Similarly is for Dialectic, which studies the dynamic of opposites *<A>* and *<antiA>;* it is referred to the dyad *(<A>, <antiA>)* that makes sense in the real world.

Consequently, the neutrosophication of a *concept* into a *(T, I, F)-concept,* or more general into a *refined (T_1, T_2, …; I_1, I_2, …; F_1, F_2,…)-concept*, is possible if the triad *(<Concept>, <neutConcept>, <antiConcept>)* or more general its refined concept triad makes sense in the real world.

2.4. Examples of Triads and Refined Triads

1) If *<A> = Table*, then *<antiTable>* and *<neutTable>* do not make sense in the real world, so we do not have a neutrosophic triad, nor a dyad.
2) If *<A> = Man,* then *<antiMan> = Woman,* and *<neutMan> = Transgender,* whence the triad *<Man, Transgender, Woman>* makes sense in the real world, therefore it is a neutrosophic triad.

In general, for <*A*> as a material thing, there is a less number of corresponding neutrosophic triads.

But for <*A*> as spiritual thing (idea, theory, attribute, sentiment, etc.), there are many corresponding neutrosophic triads.

2.5. Applications of Neutrosophic Triads in Sociology

A classical sociological *Concept*, such as: society, social class, social group, religious community, minority community, social network, social media friends,

cyber-space interaction, Internet relationship, social stratification, social relationship, principle, law, welfare, government regulation, political party, sexuality, deviance, social disorder, family, culture, etc. that may be represented as a real world neutrosophic triad

(<Concept>, <neutConcept>, <antiConcept>)

or as a real world refined neutrosophic triad

(<Concept$_1$>, <Concept$_2$>, …; <neutConcept$_1$>, <neutConcept$_2$>, …; <antiConcept$_1$>, <antiConcept$_2$>,…)

may be neutrosophicated into a

(T, I, F)-concept, or respectively into a

refined (T$_1$, T$_2$, …; I$_1$, I$_2$, …; F$_1$, F$_2$,…)-concept,

and they better model the social reality than the classical sociological analyses.

2.6. Neutrosophic Social Degrees

In all societies we find neutrosophic degrees of positive (T), indeterminate or neutral (I), and negative (F) attributes, therefore we could say that in any society we have the following neutrosophic degrees:

(T_i, I_i, F_i)-inequality, (T_u I_u, F_u)-unhappiness, (T_c, I_c, F_c)-contradiction, (T_w, I_w, F_w)-wrongdoing, and so on,

unlike Auguste Compte's (who coined the 'sociology' term) "perfect society" – because we people are imperfect and commit mistakes.

The neutrosophic degrees are dynamic, they continuously change in time upon various hidden or unhidden parameters that influence them.

Neutrosophic Study of the Society

We can look at each idea in any field of knowledge from various points of view. But to a sociological idea, the points of views are indefinitely multiplied!

While in classical books the 'sociology is the scientific study of society', we extend this definition to **the sociology is the neutrosophic scientific study of society**.

Why 'neutrosophic'? Because the scientific study is based on empirical data and big-data that is not well determined to comprise all categories of groups of people and their relationships (so it is incomplete, unclear data, vague data, hesitant data, contradictory data etc.).

Neutrosophic logic, set, probability, and statistics are best tools and methods for science.

Neutrosophic sociological research can be used by agencies, corporations, government, policy makers in order to make decisions about their companies or groups of people.

In general, because of indeterminate, incomplete and conflicting data, and due to the degree of subjectivity that is employed in all social sciences, we may talk about **neutrosophic social sciences**: neutrosophic sociology, neutrosophic anthropology, neutrosophic psychology, neutrosophic political science, and so on.

In our society the people (one-to-one, as in microsociology) and the (small or big) groups of people co-exist in some *degree of combination* (interaction) with each other, some *degree of isolation*, and some *degree of unclear combination-isolation* among themselves [as in neutrosophy].

And combination is characterized by a degree of cooperation, degree of conflict, and degree of neutrality or indeterminacy with respect to cooperation-conflict [therefore, neutrosophy within neutrosophy].

Neutrosophic Statistics may be utilized as a quantitative research method in sociology in order to test social hypotheses.

We need to understand the triad, alike: how people take decisions, reject them, or remain in pending (undecided).

Society has a plenitude of cultures, subcultures (opposed to cultures), and ignorances.

On the other side, the society includes microcultures (at small groups' level), and macrocultures (at transnational level).

The aphorism 'doesn't matter what you know, but who you know', or your personal network, functions perfectly in our permanently changing, overcomplex, overdiverse, highly controversial society.

It's a web of friends and enemies and neutrals that everybody is caught in.

The social organizations behave as dynamic neutrosophic open systems, because they are influenced by other organizations, they are continuously socially changing and governed by degrees of uncertainty.

How to organize the unorganisable?

How to mathematically model the unmodelled society?

How to extract the main pattern from a multipattern society?

The conflicts and cooperations between individuals and society bring **the neutrosophic social change**.

2.7. Sociological Forecasting

— How we can use the neutrosophic probability (which studies the chance that a social event occurs, the indeterminate-chance about the social event to occur or not, and the chance that the social event does not occur) to predict a future social event?

— What will be the family of the future: traditional (male-female), single, polygamy, polyandry, or group family? Who will lead the family (if any)?

2.8. There are Many Truths and Many Falsehoods

In social life, for the same action or event or idea, there are many truths (not only one) - as in refined neutrosophy. And many falsehoods, similarly.

Every individual has his own right and wrong about social facts. And any little or big group of people too. What for somebody may be seen as 'good', for others may be interpreted as 'bad' – and reciprocally, while there may be others considering them as ambiguous…

We live in a multi-valued neutrosophic society.

2.9. Neutrosophic Social Norms

Society's norms are actually **neutrosophic social norms**, since each norm has a degree of **right**, a degree of **wrong**, and a degree of **indeterminacy** (not sure if it's right or wrong).

2.10. *(t, i, f)*-Social Patterns

We study the neutrosophic sociology by observations and their neutrosophic analysis, by experiments, by theoretical or moral questions, by formulating hypotheses, then testing them empirically (by collecting facts) or theoretically, then generalizing

them in some degree to get theorems, properties, corollaries, etc. Actually we look for social patterns, we better describe them as *(t, i, f)-pattern*, which means a pattern which is *t%* true, *i%* indeterminate, *f%* false, where *t, i, f* are numbers in the unit interval *[0, 1]*.

In pure science, we consider only *(1, 0, 0)-patterns*, i.e. a patterns (laws, principles, theorems, properties, axioms, etc.) which are *100%* true, *0%* indeterminate, and *0%* false in the whole scientific space.

But, our reality is full of uncertainty and conflicting and vague information, and if the space is the society, which includes objective and subjective things, which are permanently changing and hard to predict, we find only partial truth/indeterminacy/falsehood.

2.11. *(T, I, F)*-Social Rules

All institutions that did and do social investigations, such as: governments (through social workers, legislators, fire fighters, police officers, etc.), think tanks, research colleges and universities, feminists, political parties, animal rightists, gay and lesbian activists, minority leaders, anti-discriminatory advocates, health laboratories, business companies, various organizations, religious groups, journalists, professors, and so on, actually do neutrosophic sociology since they deal with rough, incomplete and inconsistent data, from where they cannot extract/deduce 'exact' general rule that may apply to the whole society, but only a partial rule, that we call

(T, I, F)-rule: partially (T%) applies, partially indeterminate (I%, not sure if applying or not), and partially (F%) not applying.

Surely, the goal is that $(T, I, F) \to (1, 0, 0)$ idealistically, but realistically t should be as big as we can get, and I, F as small as we can get, where $0 \leq T, I, F \leq 1$, as part of deneutrosofication.

The degree of objectivity should overpass the degree of subjectivity in creating/establishing/determining a new social rule, where (T, I, F)-rule means T% = degree of objectivity, I% = degree of indeterminate objectivity or subjectivity, F% = degree of subjectivity.

Avoid your own preconceptions and the stereotypes, before enouncing a (T, I, F)-rule.

2.12. There are Many (even Opposite) Solutions to the same Social Problem

In neutrosophic sociology to the same problem there are many **different solutions**, to the same social fact many definitions and many descriptions.

No social answer is the only 'right' answer. 'We agree to disagree' says a witticism. We should understand the differences and resemblances between people, and separate what doesn't matter from what matters in finding a social pattern, or sometimes just have a rough guess. While neutrosophic sociology looks over-simplified in general, it is overcomplicated in particular.

The society's rules change in time, due to an event or another or to the trends; so we re-write a neutrosophic social explicit or implicit rule as: $\langle \mathcal{T}(t), \mathcal{I}(t), \mathcal{F}(t) \rangle$ -social rule, where ($\mathcal{T}$, $\mathcal{I}$, $\mathcal{F}$) are functions of time (t).

2.13. Neutrosophic Social Situations

There often are **social situations** when it is hard to decide right from wrong: right from a point of view, and wrong from another point of view, and even unclear from a third point of view.

The definitions of 'right', 'wrong', or neither ('unclear') may be subjective, or may be determined with respect to various parameters. For example, polygamy is right in Islam and Mormonism, but wrong in Christianism, Buddhism, or Hindi.

Is the polygamist family wrong? If you ask a Christian, or a Buddhist, or a Hindi, he would say: 'Yes'. If you ask a Muslim, he would say: 'No'. If you ask a celibate, not interested in making a family, he would say: 'I don't care'.

What is the correct answer? All and none!

Should the capital punishment (death penalty) be abolished as inhuman, or not?

Do we need a Big Government or Small Government?

Should the religious symbols be removed from the government building or not?

Some people support abortion, other are against. Similarly, about same sex marriage, and so on.

And everybody is right and wrong simultaneously. The Paradoxism (contradictions) in society, and Neutrosophy (contradictions and indeterminacy) play a strong role.

'You are who other people think you are' (Joseph Scrimshaw), and you learn by interacting with your primary group (Charles Cooley). But you also learn to be yourself, different from what other people think about you.

So, you are many you's and many other's.

We use neutrosophic probability and neutrosophic statistics to study and analyse social facts, behaviours, and causes.

The definitions of 'right', 'wrong', 'indeterminate' have changed in time, and they are different from a culture to another culture. They are neutrosophically dynamic.

2.14. Neutrosophic Social Systems

The **social systems** are more 'unstable' than 'stable' – despite the humankind's dream along entire history to tend towards stability.

The social systems are frequently fluctuating between 'apparent stability' and 'instability'. Since the word 'sociology' was first coined by the French thinker Auguste Comte (who believed in **positivism** – that humans can improve their circumstances), in the early

1800s, the **scientific** study of social systems ignited interest.

A social system (society, organization, association, ethnic minority, family, community, religious group, club, etc.) is studied **empirically** (counting facts, events, beliefs, observations, etc.) and afterwards using the methods of natural sciences, **approximate scientific** conclusions are deduced. The conclusions may be under the form of (*t*, *i*, *f*)-ideas, or (*t*, *i*, *f*)-statistics.

Is a social system better organized then another? Is a social system more disorganized than another? Each social system has a degree of 'good organization', a degree of 'bad organization' (disorganization), and a degree of 'fluctuation' (indeterminacy) between organization and disorganization.

The referential system is crucial in judging "good" from "bad".

2.15. Double Standard and Hypocrisy

What about the **Double Standard**, so much unfortunately always used: judging your friends or your favoured ideas from a positive standpoint, while your enemies or your un-favoured ideas from a negative standpoint…

What about **Hypocrisy**, also frequently used: to criticize your enemies or un-favoured ideas from a point of view; but not criticizing your friends or favoured ideas from the same point of view…

Or praising your friends and favoured ideas from a point of view, but not praising your enemies and un-favoured ideas from the same point of view…

What is considered positive in a culture may be negative or at most ignorant (neutral) in another culture. Yes, the culture unites and separates people.

Religion as 'the opiate of the people' (Marx) is true for non-believers, but it gives spiritual hopes to believers. However, the cosmopolites do not really care about culture and religion.

Let's study the social system as a whole and afterwards trigger actions between its parts.

2.16. Neutrosophic Social Grand Theories

Social Grand Theories mean to find abstract ideas about concrete facts in large social groups, but they may be difficult to formulate and pursue in classical way. Better they are represented in a *(t, i, f)*-degree neutrosophic way.

2.17. Neutrosophic Social Change

The **Social Change** is imminent in all social structures, and the *(t, i, f)*-change gradient has a large spectrum.

2.18. Neutrosophic Ideal Social Group

There is no **Ideal Society** (as dreamt by Marx) for everybody, but each society is ideal for a minority of people only (mostly those at the society top), for others at the society bottom it is hell, while people in the middle are either ignorant or fluctuating between happiness and unhappiness with regard to the society's style. Thus, we always have a neutrosophic ideal society (the triad of opposites and their neutral persists). And, in general, the same for any social group. There will never be an ideal social group for all, because always some individuals will have more privileges than others. Even in a democratic society, a minority of people have more privileges than the majority.

2.19. Contribution and Benefit from the Society

In each society everybody should have as many privileges as his or her contributions to the society. But how to measure these?

There are internal and external social conflicts. The social conflict will be persistent and steady in any social system, as part of the system's dynamicity, so Marx's assertion that no more conflict will exist in a communist (or socialist) system is a utopia. There also are conflicts between internal individuals and external individuals.

2.20. Minimum Effort and Maximum Gain

People's conscience is not for egalitarianism, or collectivism (that everybody contributes what he can, and takes what he needs – as Marx thought it would a perfect social system), but for the opposite: *Minimum Effort and Maximum Gain!*

2.21. Fight for Social Domination

People's conscience is for goods, power, fame, and domination over others. Consequently, a social system, as a whole, fights for domination of other social systems.

The competition is not bad, it brings indeed progress. But competition is not always honest, it degenerates in violence, personal attack, trickery, etc.

2.22. Neutrosophic Social Classes

The **Bourgeois** and **Proletariat**, Marx's most important antagonistic social classes, are balanced today by an increasing **Middle Class** which is partially wealthy (the upper middle class) and partially un-wealthy (the lower middle class).

Countries like France, Germany, China have strong middle classes.

Technology's progress has been reflected into Marx's **Mod of Production** and citizens' higher level of life.

Emile Durkheim has predicted a more complex and larger future society, where the genuine diversity will drastically increase, and so the **Division of Labor**.

2.23. Neutrosophic Global Society

In our days, Internet gave rise to a **Global Society**, where all people around the world meet online and exchange true and false, conflicting, vague, uncertain information.

2.24. Degree of Neutrosophicity

The *degree of neutrosophicity* (indeterminacy, ambiguity, incompleteness, contradictory ideas, confusing sentiments and opinions, etc.) has dramatically increased into the world.

All social systems became more flexible and open, including the religious systems that are now less dogmatic and more ecumenical, while the laws are telling citizens 'what not to do' instead of 'what to do'.

All social systems are intertwined as chess pieces into the Global System.

Functional Differentiation of social systems and Increasing Diversity in social systems trigger social change – according to Durkheim.

2.25. Neutrosophic Social Research

Making generalizations from particular findings is extremely risky, since the society - dealing with huge

data - is continuously changing, very diverse, and extremely complex with conflicting social events and entities. A social statement, almost true today, may be almost false tomorrow. Therefore, the contradiction and uncertainty (neutrosophic characteristics) are unavoidable…

2.26. Neutrosophic Big Data

Social Empirical Research is done by observations of the real world: asking *empirical questions*, and making *empirical answers*.

There is a *degree of randomness*, as in statistics, depending on the (people, situations) sample we observe, and of cause a *degree of interpretation* of what we see.

One has quantitative and qualitative data.

Computer software may help today to analyse and find trends and patterns through Big Data mining, by using implemented algorithms that look for specific key-words or key-phrases.

The Big Data we use may have missing information, inconsistent statements, vague data – in a word: some percentage of 'indeterminacy'. We need to do a **deneutrosophication** process in order to remove or at least diminish the indeterminacy's gradient.

Another problem: Is the data representative for the entire population or not? What level of confidence do we have?

2.27. Neutrosophic Social Causality

In the *social causality* research, what involves what, since the social systems are more flexible and as an amoeba, a classic implication $A \to B$ is replaced by an approximate implication $A \to_N B$, or 'A neutrosophically causes B':

$A(\mathcal{T}_A, \mathcal{I}_A, \mathcal{F}_A) \to_N B(\mathcal{T}_B, \mathcal{I}_B, \mathcal{F}_B)$.

Most social researches are *cross-sectional* (at a single point in time), while *longitudinal* (at multiple points in time) ones are rarely done. Using statistics for classical sociology, or neutrosophic statistics for neutrosophic sociology, we can check *social hypothesis*.

2.28. Neutrosophic Internet of Things (NIoT)

The **Globalization** with this exponentially increasing technology, shows us a permanent (sometime abrupt) social change, increased diversity from one side (new types of jobs, businesses, social media activities), and paradoxically increased homogeneity (cities looking more similar), increased communications and connections, transnational corporations [*Corpocracy*] that will be above the states, increased tourism, increased middle class (contrarily to Marx's vision), increased competition for jobs, big data resuming to just little information [meaning a lot of ignorant, useless or indeterminate data], automatization all over, Internet of Things, Smart Cities, etc.

2.29. Neutrosophic Network

The sociologists have represented the society as a network. Analyzing a society means to analyzing a network, which goes by *rules* and imposes *limits*.

While there are individuals who play by rules, others play against the rules, and others who do not play at all!

2.30. Neutrosophic Microsociology

The way people, in small number, react and interact in their group but taken into consideration the large degree of indeterminacy related to their relationships, is called neutrosophic microsociology. Extracting exact patterns and/or exact trends from this rough Big Data is a tough work. Sociology goes hand in hand with psychology, anthropology, political science. Studying the society's trends, it may be possible to predict (in some degree) the possible conflicts, cooperations, or ignorances among individuals.

2.31. Neutrosophic Society

We live in a Neutrosophic Society, which is a society that has some degree of capitalism, some degree of socialism, and some degree of communism…

More accurately we can describe and study microsociology and macrosociology using neutrosophic logic and neutrosophic probability, than classical logic and classical probability respectively.

Third Chapter

Neutrosophic Materialism, an Extension of Dialectical Materialism

3.1. Dialectic vs. Neutrosophy

Since neutrosophy, a new branch of philosophy, is a generalization of dialectic, we extend the dialectical materialism to neutrosophic materialism.

a) In **Hegelian Dialectic**, a *thesis* gives rise to its *antithesis*, and their contradiction is resolved by a *synthesis*.

In **Neutrosophy**, in order to solve the contradiction between opposites $\langle A \rangle$ and $\langle \text{anti}A \rangle$ (*thesis* and *antithesis*), the neutral $\langle \text{neut}A \rangle$ contributes to one side or to the other or to both (*neutrothesis*). The contradiction is resolved in *neutrosynthesis*. The dialectic's triad (*thesis & antithesis* → *synthesis*) is extended to a quadruple by neutrosophy (*thesis & antithesis & neutrothesis* $\rightarrow_N$ *neutrosynthesis*), which better reflects our reality.

In a more elaborate **Refined Neutrosophy**, between $\langle A \rangle$ and $\langle \text{anti}A \rangle$ there is a plethora of neutralities $\langle \text{neut}A_1 \rangle$, $\langle \text{neut}A_2 \rangle$, … that contribute some to one side ($\langle A \rangle$), others to the opposite side ($\langle \text{anti}A \rangle$) to resolve the contradiction – as in a war when two countries fight, and others interfere in one side or the other.

b) **Engels' Dialectics** are upgraded in the following neutrosophic way:

1) The first law (derived from famous Chinese Yin-Yang and from Greek philosopher Heraclitus, and later from Hegel and Lenin), about unity and conflict of opposites, is extended to the unity and conflict of

opposites and their neutrals, since at least some neutrals interfere between the opposites in one side or the other.

2) The second law (ancient Anaximenes and Aristotle, and later Hegel and Engels), that from quantitative changes one passes into qualitative changes partially apply into our world. Quantitative changes bring mostly routine or even more quantitative changes. While qualitative changes may occur not only gradually, but spontaneously as well.

3) The third law (Hegel and Marx), or negation of the negation.

*

Engels's materialist dialectic is rather a materialist and idea(tionist) neutrosophy.

Since in our world the opposites act and react at all levels of matter and of ideas, of objectivity and subjectivity, of conscious and unconscious, of rational and of feeling etc., and the opposites are endorsed or enforced by some neutrals, or repelled by other neutrals.

The neutrals join the unity and conflict of opposites. Extending Lenin's thought, we may say that: Development is not only the struggle of opposites, but of opposites and their neutrals.

According to Marx [*Das Kapital*]:

First Negation: The negation of Feudalism is Capitalism.

Second Negation (called Negation of Negation):

The negation of Capitalism is Communism.

Yet, in our times, we need to add a

Third Negation (called **Negation of Negation of Negation**).

The negation of Communism is (back to) Capitalism, which occurred in communist countries like China, Russia, Vietnam etc., that have converted their inefficient communist economies into capitalistic ones, which are more efficient.

As in Boolean logic, we have below.

Let "non" mean negation. Then:

First Negation:

non(Feudalism) = Capitalism.

Second Negation:

non(non(Feudalism)) = non(Capitalism)
= Communism.

Third Negation:

non(non(non(Feudalism))) = non(non(Capitalism))
= non(Communism)
= Capitalism.

The Capitalism and Communism negate each other!

3.2. Neutrosophic Society

'The communism will appear in the most developed capitalist country of the world, peacefully, by concentrating at the top the capital in transnationals that will go beyond the state, the state becoming an enemy.' (Karl Marx)

Contrarily to Marx, in the 21st century the capitalism appeared in the most developed communist countries of the world, China and Russia, peacefully, by large number of privatized companies and institutions, and by smaller state capital.

However, in consensus with Marx, the socialism has also appeared in many developed capitalist countries of the world (France, Germany, northern countries: Denmark, Sweden, Norway), peacefully, by a plenitude of social programs, welfare, free medical assistance, free education, and retirement for all.

In the 21st century the transnationals dominate the global economy and the mode of production, in assent with Marx.

It does not exist a pure *Capitalist Society* ($\langle A \rangle$), nor pure *Communist Society* ($\langle \text{anti}A \rangle$), but it does exist what we call *Neutrosophic Society* ($\langle \text{neut}A \rangle$), which is a society partially capitalist ($\langle A \rangle$) and partially communist ($\langle \text{anti}A \rangle$). Where $\langle \text{neut}A \rangle$ is a blending of opposites $\langle A \rangle$ and $\langle \text{anti}A \rangle$.

Even the worst Capitalist Society (with a degree of capital very high) has some degree of communism, such as: social programs for poor and for homeless.

Similarly, the worst Communist Society (with a degree of communist ideology very high) has some degree of capitalism, such as: small private farms, small craftsmen, constructors and repairers that do private work, small pawnbrokers, private tutors, etc.

In a *Socialist Society*, the degree of capitalism is smaller than the degree of communism. The Socialist Society is between Capitalist Society and Communist Society.

While in the Capitalist Societies, the degree of capitalism is greater than the degree of communism.

3.3. Classical Materialism

While Hegel used dialectic for **ideas**, Marx used dialectic for **matter**.

For Marx, the matter goods and basically all economic forces were important – whence the **Classical Materialism**.

Unlike **Classical Metaphysical Materialism**, which studies a static and not connected material environment, the **Classical Dialectical Materialism** studies a dynamic, interconnected, and evolutionary material environment.

3.4. Neutrosophic Materialism

As a neutrosophic extension of materialism, the **Neutrosophic Materialism** examines a *(T_d, I_d, F_d)-dynamic*, *(T_i, I_i, F_i)-interconnected*, and *(T_e, I_e, F_e)-evolutionary* material environment, that in a degree of *(T_p, I_p, F_p)-prevails* over ideological environment.

We recall that, for any "concept" its neutrosophication "*(T, I, F)-concept*" means: *T%* true, *I%* indeterminate (or neutral), and *F%* false, where *T, I, F* are subsets included in the unit interval *[0, 1]*. For

simplicity, we consider the particular case when *T, I, F* are single-valued numbers in *[0, 1]*.

The neutrosophic materialism actually includes both the classical dialectic materialism and the classical metaphysical materialism.

The neutrosophic materialism comprises multiple spectra of neutrosophic degrees, such as:

- degrees of dynamicity / indeterminacy or fluctuation / static(ity),
- degrees of connectivity / indeterminacy or neutrality / nonconnectivity,
- degree of evolution / indeterminacy or neutrality / involution,

from a society to another society, from a country to another country, from a historical time to another historical time, etc.

This is because there are particular neutrosophic degrees of dynamicity between several material environment parts, and different neutrosophic degrees of dynamicity between other material environment parts.

Similarly for neutrosophic degrees of interconnectivity of material environmental parts, and neutrosophic degrees of evolution of material environmental parts.

Classical Metaphysical Materialism can be neutrosophically expressed as:

(0, 0, 1)-dynamicity, and *(0, 0, 1)-interconnectivity.*

Through Neutrosophic Materialism new *(T_q, I_q, F_q)-qualities* emerge:

when some qualities evolve, other qualities may involve, and there are qualities that may remain unchanged or their change may be unclear.

And *(T_l, I_l, F_l)-law* system governs the *(T_e, I_e, F_e)-evolutionary* process.

3.5. Neutrosophic Historical Materialism

The **Classical Historical Materialism** is Marx's materialist conception of History.

We argue that **History Change** is produced by **Material** (T_h %), **Phenomena** (I_h %), and **Ideas** (F_h %), where T_h, I_h, F_h are numbers included in *[0, 1]*.

not because of *class conflict* only (as Marx advocated),

or because of *ideas and culture* only (as Hegel advocated).

Thus, we now extend (or neutrosophicate) the Classical Historical Materialism to a better reality-fitting *(T_h, I_h, F_h)-Historical Materialism*, called **Neutrosophic Historical Materialism**, where all together *material, phenomena,* and *ideas* contribute to the History Change.

Each historical period has a distinct **mode of production** according to Marx, and distinct **culture and ideology** according to Hegel. Neutrosophically each historical period has both distinct mode of production together with distinct culture and ideology.

While Marx was **suspicious about society**, Durkheim **enjoyed society**. We actually have degrees

of *suspiciousness, enjoyment,* and *ignorance* (or the triad of opposites and their neutral) with respect to any society.

Marx's **historical materialism** (or materialist conception of history) is better extended to **materialism** (in a neutrosophic way) as degree of materialism, degree of ideology, and indeterminate materialism-ideology degree.

Marx thought that **society change** is about **the haves and the have-nots**, Durkheim thought about a functional differentiation as society's more complex exchange. According to Durkheim, a **group's behaviour** is different from an **individual behaviour**.

The weather influences people's *psyche*, for example the northern countries in colder and darker weather get depressed in a higher number and at a higher rate than southern countries in warmer and sunny weather.

Society's organization: citizen living in a dictatorship get depressed in a higher number and degree than citizen living in a democratic society.

Karl Marx argued that social life was based on **conflict**, Emile Durkheim on **cooperation** (society resembles an organism), while Max Weber has concluded that social life is based on **both conflict and cooperation** – that we agree with and complete it with… ignorance.

Neutrosophic social life is based on *degrees of conflict, degrees of cooperation, and degrees of neither (or ignorance, neutrality).*

While Marx repudiated the **capitalist system**, Weber accepted it, but he called it 'iron cage', where people are locked by standard rules and roles in society.

The real world is more complex, not only black and white, yet grey as well. And so, the capitalist system. From people's perspectives of the capitalist system, there are: *degrees of repudiation, acceptance, and ignorance (neutrality).*

However, at the end of *20th* century and the beginning of the *21st* century, we encounter more **neutrosophic social systems** (i.e. *communisto-capitalist societies*) such as China, Vietnam, Russia, whose state capital is dominant, but important private capital does exist. The political system is communist, but the economy is capitalist.

And, instead of an aggressive (jungle) capitalism, a more mild capitalism (i.e. *capitalisto-socialist societies)* in countries as France, Germany, northern European countries).

Fourth Chapter

Neutrosophic Social Evolution:

Degrees of Evolution, Indeterminacy, and Involution

4.1. Extension of the Process of Evolution

While dialectic implies a **Process of Evolution** of <A> and <*antiA*>, neutrosophy implies a **Neutrosophic Process of Evolution** of $\langle A \rangle$ and $< antiA >$, which means: a *degree of evolution* (with respect to some parameters that characterize both $\langle A \rangle$ and $\langle \text{anti}A \rangle$), a *degree of neutrality or unclear evolution-involution* (with respect to other parameters that characterize both $\langle A \rangle$ and $\langle \text{anti}A \rangle$), and a *degree of involution* (with respect to a third category of parameters that characterize both $\langle A \rangle$ and $\langle \text{anti}A \rangle$).

4.2. Theory of Neutrosophic Social Evolution: Degrees of Evolution, Indeterminacy, and Involution

We consider Talcott Parsons's believe in 'Social Evolution' as partially true and partially untrue. Similarly as C. Wright Mills, we do not agree with Parsons's 'survival of the fittest societies', since many social problems exist (and will ever exist) in any society, so we'll never succeed to remove all bad from the society. Technology increases people's wealth, but in the same time diversifies, increases, and creates new kinds of social problems (cyber-crimes, identities stolen online, electronically bullying, etc.) We know extend for the first time Parsons's Social Evolution to the Neutrosophic Social Evolution.

Each society is characterized by a plenitude of social parameters.

A social change makes the society to **evolve** (as Parsons stated in his **functionalism**), but only with respect to some social parameters, **involve** (regress) with respect to other parameters, and remains the same or society's change is unclear (**indeterminacy**), with respect to another set of social parameters – as in neutrosophic logic: logic ($\mathcal{T}$), neutral or indeterminate ($\mathcal{I}$), and falsehood ($\mathcal{F}$).

4.3. Example of Neutrosophic Social Change due to Technology

The apparition of Internet and mobiles have produced:

Social evolution:

— faster and cheaper communication;
— distance education (e-learning);
— e-meetings;
— e-commerce;
— e-jobs;
— e-dating;
— e-statistics, etc.

Social involution:

— less privacy (due to mass electronic surveillance);
— cyber-crimes;
— addiction to mobiles;
— autism;
— online bullying;

— stolen identity;

— brain tumour due to electronic devices' radiation, etc.

Neither social evolution, nor social involution (neutral or unchanged social things):

— people still make friends, enemies, or neither (neutrals);

— people still vacation, play, work, etc.

4.4. Refined Neutrosophic Evolution

A more detailed evolution of the society, called Refined Neutrosophic Evolution, is described by *Refined Neutrosophic Logic*:

A social change makes the society to get degrees of evolutions ($\mathcal{T}_1$, $\mathcal{T}_2$, …) with respect to each of some social parameters, degrees of involution ($\mathcal{F}_1$, $\mathcal{F}_2$, …) with respect to each of the other social parameters, and degrees of neutralities (neither evolution, nor involution) ($\mathcal{I}_1$, $\mathcal{I}_2$, …, $\mathcal{I}_n$, $n \geq 0$) with respect to each of a third set of social parameters, and degrees of uncertainties (not clear if it is evolution or involution) ($\mathcal{I}_{n+1}$, $\mathcal{I}_{n+2}$, …) with respect to each of a fourth set of social parameters.

Fifth Chapter

Neutrosophic Functionalism

5.1. Parsons's Functionalism

Parsons's Functionalism explains the social phenomena by the way they function.

This is **true** for some social institutions and phenomena (such as government, education, religion), and **false** for others, since people (that have both society's and their own interests in mind) created the social institutions, not the functions;

and, according to sociologist C. Wright Mills, the social problems that persist in society were neither necessary not normal.

5.2. Neutrosophic Functionalism

On the other side, there are social phenomena which are **indeterminate**; for example, an insurgent movement arising ad-hoc in a country against an occupant power; the insurgent movement is created by the function (the need to repel the occupant), but it is also created by fighters whose leaders' motivations would be to get recognition for heroism and possible power position in their country's government in case of success.

Neutrosophic Functionalism explains the social phenomena partially by the way they function, partially by the way they are created by people, and partially by both (the way they function and the way they are created by people).

5.3. The 'Power of Elite'

In his book 'The Power Elite', C. Wright Mills argued that a small group of powerful and rich people run the society for their own profit.

Let's neutrosophically study this theory in various real spaces (societies).

— In a **dictatorship** and in an **absolute monarchy**, Mills's theory has a high degree of truth.

— In a **democratic strong-capitalistic republic** (such as U.S.A.) and in a **constitutional monarchy** (such as U.K.), Mills's theory has a less degree of truth than the previous two societies, since the elite's decisions and laws have to be approved by some parliament or senate.

— In a **democratic socialistic-style capitalist republic** (such as France, Germany, Sweden, Denmark etc.), Mills's theory has an even lower degree of truth than all above, since there is a large and strong middle-class that riots against elite's power abuse, there are trade-unions (that curve the elite's power), and there are many social programs for helping the poor and middle-class (for health, retirement, unemployment).

Similar study may be done for ancient societies (slavery, feudalism, etc.).

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Neutrosophic Sociology (or **Neutrosociology**) is the study of sociology using neutrosophic scientific methods.

The huge social data that we face in sociology is full of *indeterminacy*: it is vague, incomplete, contradictory, hybrid, biased, ignorant, redundant, superfluous, meaningless, ambiguous, unclear, etc.

That's why the *neutrosophic sciences* (which deal with indeterminacy), through the process of neutrosophication, are involved, such as: neutrosophy (a new branch of philosophy), neutrosophic set, neutrosophic logic, neutrosophic probability and neutrosophic statistics, neutrosophic analysis, neutrosophic measure, and so on.

Neutrosophy studies only the triads *(<A>, <neutA>, <antiA>),* where *<A>* is an item or a concept, that make sense in the real world.

The process of neutrosophication means:

- converting a crisp concept {i.e. *(1, 0, 0)-concept*, which means concept that is *100%* true, *0%* indeterminate, and *0%* false} into a neutrosophic concept {i.e. *(T, I, F)-concept*, which is *T%* true, *I%* indeterminate, and *F%* false – which more accurately reflects our imperfect, non-idealistic reality}, or more general into a *refined* $(T_1, T_2, \ldots; I_1, I_2, \ldots; F_1, F_2, \ldots)$*-concept*;

- or the conversion of a crisp *(1* or *0),* fuzzy *(T),* or intuitionistic fuzzy *(T, F)* numbers into a neutrosophic number *(T, I, F);*

- or the conversion of a crisp (exact) number *N* into a neutrosophic number of the form $N = a + bI$, where a is the determinate part of number *N* and bI the indeterminate part of number *N*.

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